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The EU sovereign debt crisis: potential effects on EU banking systems and policy options

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Abstract

This paper aims at investigating some of the critical issues highlighted by the sovereign debt crisis in European Union (EU) Member States (MS). The goal is twofold:

1) Quantify the increase in the risks of the EU banking systems due to haircuts of sovereign debts of some EU Member States, which have been particularly touched by the sovereign crisis;

2) evaluate and compare the policy options which have been adopted to address the issue.

The first goal is achieved by estimating the increase in the banks Probability to Default (PD), due to the haircuts in sovereingn debts, through a further development of the SYMBOL model to estimate the PDs by numerical inversion of the Basel FIRB formula for minimum capital requirements.

For the second objective the measures within the Basel III Accord, which among the others increases the quality and quantity of capital that banks should set aside to cover from unexpected losses, are compared with the agreement on bank recapitalisation and funding reached by the European Council in October 2011, which responded to the urgent consequences of the sovereign bonds crisis in the EU.

The analysis is performed on the 65 large EU banking groups identified by the European Banking Authority (EBA) for the capitalisation exercise..

Results show that the haircuts on sovereign debts of EU MS in crisis would heavily worsen the stability of their banking systems but could also sometimes affect financial stability of other EU countries. We also show that the creation of a temporary capital buffer in the form of a capital target, necessitated by the exceptional circumstances prevailing in some EU MS, represent a step forward to Basel III rules.

Keywords: banking stability, sovereign bonds, systemic risk.

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1. Introduction

In the last few years the EU MS have been facing two interrelated crises: a banking crisis, stemming from losses in capital markets as well as from property markets in some EU countries; and a sovereign debt crisis driven by the effects of the recession on the budget and on the re-assessment of sovereign risk by financial operators, the transfers necessary to support the finanial sector, and in some cases very poor fiscal management over a number of years (Blundell-Wignall and Slovik, 2011). A number of policy initiatives have been initiated to address these crises, both on the fiscal and on the banking side. On the fiscal side, the reform of the Stability and Growth Pact has reinforced surveillance aiming at the medium-term. The creation of the European Financial Stability Facility followed by the creation of the European Stability Mechanism allow supporting euro area member states facing sovereign crisis and systemic banking difficulties. Further initiatives have been taking to tackle the difficulties of the banking sector, in the short-term with the intervention of the European Central Bank and in the medium term with the creation of the banking union and of a reinforced regulation. Among this actions, the banking sector has been particularly concerned by the new Basel Accord (BCBS (2011)) and the European Council agreement on bank recapitalisation and funding (EURO Summit (2011), EBA (2011)), which we analyse in the present paper.

The present performs two different exercises. First, it investigates the impact on the European banking systems of haircuts of sovereign debts of selected EU MS. Are chosen the MS which have been mostly hit by the turbulence in the sovereign markets, namely Greece, Italy, Spain, Italy, Ireland and Portugal. The existing SYMBOL model (see De Lisa et al. (2011)) is furtherly developed in order to assess the default probability of banking groups with respect to sovereign haircuts.

Second, the exercise compares two policy options relative to banks recapitalization, following the new Basel agreement of 2012 and the corresponding recapitalization needs.

The Basel III Framework, signed in 2010, stipulates that banks should hold more and better capital in order to *improve the banking sector's ability to absorb shocks arising from financial and economic stress, whatever the source, thus reducing the risk of spillover from the financial sector to the real economy*. In particular banks are required to build adequate Counter-Ciclycal Buffers (CCB) above the minimum, that can be drawn down in periods of stress. The total minimum capital requirement including the CCB raises from 8% to 10.5% of the Risk Weighted Assets (RWAs). The package also includes a revision for a stricter definition of regulatory capital, and higher weights for some categories of risk. These new rules should be implemented within 1st of January 2019, after a phase-in period.

As an urgent answer to the severe consequences of the sovereign debt crisis, which turned out well before the foreseen Basel III implementation, on 26 October 2011 the Members of the European Council reached an agreement on bank recapitalisation and funding to create a temporary capital buffer of 9% Core Tier 1 ratio by 30 June 2012. The buffer is intended to tackle the extraordinary

pressure on some Euro-area sovereigns and the related impact on the cost and availability of bank funding.[1]

The remaining of this reports develops as it follows. Section 2 presents the dataset used for the analysis. Section 3 focuses on the impact on EU large banking groups of haircuts of sovereign bonds of selected countries and presents the methodology used. Section 4 analyzes the policy options considered to address the issue. Section 5 reports data on the foreign exposures of the european banking groups before and after the exercise.

2. The Dataset

The exercises are performed on the sample of banks which participated in the 2011 EBA stress test, except for the subset of small non cross-border banks that has been exempted from the exercise. Annex 1 presents the list of the groups included.

Our analysis is based on the following two sets of data:

- Balance sheet data from Bankscope as of December 2010. In particular for the analysis of capital levels and for SYMBOL estimations the variables capital requirements, total capital and total assets are used. These data are summarized per country in Table 1. The table aggregates per country the data for the considerd 65 EU banking groups consolidated in the country of the parent. Figures refer to consolidated accounts.
- Sovereign debt exposures of single group exposures as reported in the European Banking Authority (EBA, formerly CEBS) Capital Exercise 2011 (EBA 2011b) of October 2011. Data on the exposition of EU banks to government bonds are normally not published, but the disclosure of the capital exercise held by the EBA includes an important cross-section of the exposures of each banking group by counterpart MS, maturity and accounting category. Data are presented in Table 2 (values) and 3 (incidence to Tier1). Table 3 and Graph 1 refer to September 2011.

The EBA Basel III monitoring exercise 2011 (EBA 2011a) is used to estimate the effects of Basel III rules. Concerning the rule proposed by the Council, we report the sovereign exposures and haircuts estimated by the EBA in executing the Council mandate, for each of the considerd banking groups, on some selected countries sovereign debts (ES, GR, IT, IE, PT). The impact the introduction of the new Basel III rules framework is monitored semi-annually by both the Basel Committee at a global level and the EBA at the European level, using data provided by participating banks on a voluntary and confidential basis, Results of the EBA monitoring exercise are summarised in a report (EBA (2011a))

[1] This decision followed the warning of the September 2011 of the European Systemic Risk Board, which recognized that sovereign risks and funding vulnerabilities within the EU banking sector could threaten financial stability in the EU as a whole and urged supervisors to coordinate efforts to strengthen bank capital, taking into account the need for transparent and consistent valuation of sovereign exposures .

which makes use of consolidated data of 158 European banks (48 Group 1 banks and 110 Group 2 banks) as of 30 June 2011.

2.1 Data description

Data on exposures show that the sovereign bonds are mainly held within the home country banking systems but that there are also relevant exposures of other MS. For instance LU and BE are rather exposed to IT sovereign bonds and CY is exposed to the risk of GR default. There are also non negligible exposures of FR, PT, DE and UK to sovereign bonds of the considered countries.

Table 1: Bankscope sample description (million Euro). Data are consolidated and aggregated per country as of December 2010. Source: Bankscope

Country	Number of groups		RWA under Basel II definition (m€)	Total assets (m€)	Capital under Basel II definition (% RWA)	Tier 1 under Basel II (m€)
	Group 1[2]	Group 2				
AT	2	1	242,475	383,576	13.4%	24,023
BE	2	0	252,545	843,458	15.5%	32,234
CY	0	2	53,904	85,218	11.8%	5,643
DE	12	1	1,263,206	5,153,876	15.4%	152,932
DK	2	2	179,612	655,963	17.6%	28,025
ES	5	0	1,374,409	2,514,380	12.7%	134,752
FI	1	0	42,728	83,969	12.8%	5,454
FR	4	0	1,910,772	5,909,518	12.7%	202,816
HU	1	0	26,774	35,083	17.5%	3,753
IE	2	1	193,622	388,394	10.1%	13,592
IT	5	0	1,085,485	2,098,238	12.6%	97,196
LU	0	1	10,687	37,935	24.0%	1,396
MT	0	1	3,381	6,335	15.0%	354
NL	3	1	731,277	2,044,126	14.8%	91,002
NO	1	0	106,168	208,161	12.9%	10,733
PL	1	0	35,670	42,837	12.5%	4,030
PT	3	1	231,395	354,560	11.4%	20,718
SE	4	0	494,117	1,255,548	12.0%	51,406
SI	0	2	20,579	23,755	10.2%	1,387
UK	4	0	2,313,352	6,446,983	15.3%	288,080
TOTAL	**52**	**13**	**10,572,157**	**28,571,913**	**13.8%**	**1,169,526**

[2] In the present exercise Group 1 banks are those banks that have Tier I capital in excess of 3 b€.

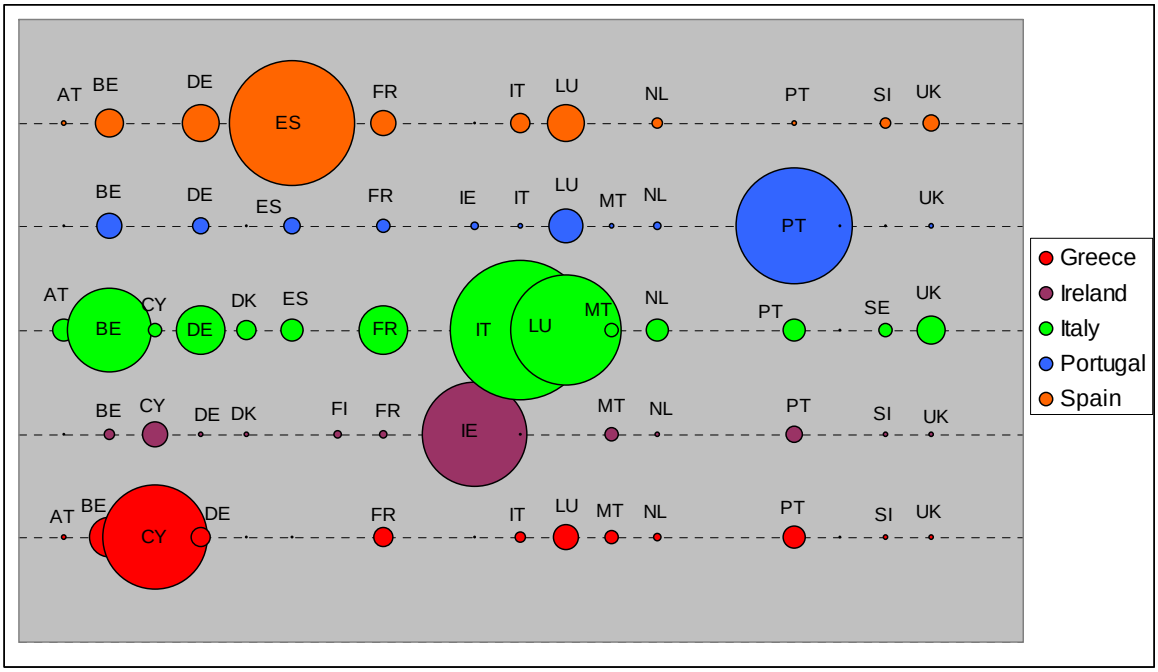
***Table 2**:* Banking groups expositions to some countries' sovereign debts, by country in m€ as of September 2011. Source: EBA

	m€				
Country	**Greece**	**Ireland**	**Italy**	**Portugal**	**Spain**
AT	127	53	1,050	27	97
BE	4,267	376	18,448	1,993	2,606
CY	4,926	361	103	-	-
DE	6,350	893	30,009	3,973	19,173
DK	58	148	1,167	35	540
ES	254	-	6,948	3,388	167,579
FI	1	41	0	0	-
FR	7,519	1,794	41,785	3,567	11,418
HU	-	-	-	-	-
IE	21	12,455	241	96	30
IT	1,466	193	156,043	292	3,768
LU	82	-	1,396	143	173
MT	7	7	6	2	-
NL	870	370	4,522	659	1,323
NO	-	-	-	-	-
PL	-	-	-	-	-
PT	1,020	547	959	22,745	96
SE	73	-	102	29	17
SI	5	9	25	3	15
UK	1,417	845	22,545	1,839	7,313
Total	**28,463**	**18,093**	**285,350**	**38,791**	**214,148**

***Table 3**:* Banking groups expositions to some countries' sovereign debts, by country as a % of Tier1 capital m€ as of September 2011. Source: EBA

	% of Basel II Tier1 Capital				
Country	**Greece**	**Ireland**	**Italy**	**Portugal**	**Spain**
AT	0.5%	0.2%	4.4%	0.1%	0.4%
BE	13.2%	1.2%	57.2%	6.2%	8.1%
CY	87.3%	6.4%	1.8%	0.0%	0.0%
DE	4.2%	0.6%	19.6%	2.6%	12.5%
DK	0.2%	0.5%	4.2%	0.1%	1.9%
ES	0.2%	0.0%	5.2%	2.5%	124.4%
FI	0.0%	0.8%	0.0%	0.0%	0.0%
FR	3.7%	0.9%	20.6%	1.8%	5.6%
HU	0.0%	0.0%	0.0%	0.0%	0.0%
IE	0.2%	91.6%	1.8%	0.7%	0.2%
IT	1.5%	0.2%	160.5%	0.3%	3.9%
LU	5.9%	0.0%	100.0%	10.3%	12.4%
MT	2.0%	2.0%	1.7%	0.6%	0.0%
NL	1.0%	0.4%	5.0%	0.7%	1.5%
NO	0.0%	0.0%	0.0%	0.0%	0.0%
PL	0.0%	0.0%	0.0%	0.0%	0.0%
PT	4.9%	2.6%	4.6%	109.8%	0.5%
SE	0.1%	0.0%	0.2%	0.1%	0.0%
SI	0.4%	0.6%	1.8%	0.2%	1.1%
UK	0.5%	0.3%	7.8%	0.6%	2.5%
Total	**2.4%**	**1.5%**	**24.4%**	**3.3%**	**18.3%**

Figure 1: Exposition of MS to the sovereign bonds of the 5 selected counties (GR, IE, IT, PT, ES). The size of the bubbles reflect the amount of exposition.



It is worth stressing that the expositions reported in Table 3 are weighted averages of the expositions of each banking group in the considered country, and that values aggregated per country are much smoother than the effects on individual banking groups. As an example, in Table 4 we specify for each MS the number of banks with exposure larger than 25% of the Tier1 capital.

Table 4: Banking groups expositions to some countries' sovereign debts for over 25% of Tier1 capital as of September 2011. Source: EBA

Country	Number of banks	Number of banks with exposure on sovereign debts higher than 25% of Basel II Tier1 Capital				
		Greece	Ireland	Italy	Portugal	Spain
AT	3					
BE	2			1		
CY	2	2				
DE	13			4		4
DK	4					
ES	5					5
FI	1					
FR	4			1		
HU	1					
IE	3					
IT	5		3			
LU	1			5		
MT	1			1		
NL	4					
NO	1					
PL	1					
PT	4				4	
SE	4			1		
SI	2					
UK	4					
Total	**65**	2	3	13	4	**9**

3. Effect of the haircut on banks' default probability

The first exercise is to estimate of the potential effects on financial stability of the sovereign crisis, and in particular of possible haircuts on sovereign debts. These effects are proxied evaluating the variation of the default probability for each banking group in our sample caused by haircuts in the sovereign debt.

This is achieved using the SYMBOL model (Systemic Model of Banking Originated Losses). The model estimates the losses deriving from bank defaults on the basis of the Basel II FIRB (Foundation Internal Ratings Based) formula, which is commonly used to analyse banks' riskiness by regulators.

The model is here further developed to compute numerically the banks' probability to default by finding the actual capital coverage of the losses probability distribution which allows to avoid performing Monte Carlo simulations.

3.1. Methodology

The SYMBOL model simulates distribution probabilities of individual bank credit losses for each bank in a banking system Such a distribution is simulated via a Monte Carlo simulation and according to the Basel Foundation Internal Ratings Based (FIRB) function loss distribution. The loss distribution of each bank is calibrated to the credit risk implied by its regulatory capital requirement.

In the present simulation exercise Monte Carlo simulations are replaced by direct computation of the loss probability distributions of the individual banks. This presents the advantage that simulation errors are avoided and computation is evidently faster.

The model operates in two steps: the first step is the estimation of an average default probability for the assets of any individual bank, by means of the features of the Basel FIRB function; the second step numerically performs the estimation of the bank's probability to default.

These two steps are based on the following:

(1) The average assets probability to default (*APD*) of each bank i $A\hat{P}D_i$ is estimated as the *PD* that allows the actual value of the capital requirement for that specific bank, K_i (extracted from balance-sheet data), to be equal to its numerically calculated value. The latter is obtained from the Basel FIRB formula, setting the other variables, i.e. loss given default (*LGD*), maturity (*M*) and size (*S*), to their standard values:

$$A\hat{P}D_i : K\left(A\hat{P}D_i \mid LGD = 0.45\ M = 2.5\ S = 50\right) = K_i$$

$$K_i\left(PD_{in}, LGD_{in}, M_{in}, S_{in}\right) = \sum_i C_{in}\left(PD_{in}, LGD_{in}, M_{in}, S_{in}\right) \times A_{in} \quad n = 1,\ldots,N$$

where K_i is the sum of the capital allocation parameter (C_{in}) of each exposure *n* of bank *i* multiplied by its amount A_{in} .[3]

$$C_{in}\left(PD_{in}, LGD_{in}, M_{in}, S_{in}\right) = \left[LGD_{in} \times \left[\sqrt{\frac{1}{1-R\left(PD_{in}, S_{in}\right)}} N^{-1}\left(PD_{in}\right) + \sqrt{\frac{R\left(PD_{in}, S_{in}\right)}{1-R\left(PD_{in}, S_{in}\right)}} N^{-1}\left(0.999\right) \right] - PD_{in} \times LGD_{in} \right] \times$$

$$\times \left[1 + \left(M_{in} - 2.5\right) B\left(PD_{in}\right)\right] \times \left(1 - 1.5 \times B\left(PD_{in}\right)\right)^{-1} \times 1.06$$

where:

$$B_{in}\left(PD_{in}\right) = \left[0.11852 - 0.05478 \ln\left(PD_{in}\right)\right]^2$$

and

$$R_{in}\left(PD_{in}, S_{in}\right) = 0.12 \frac{1-e^{-50PD_{in}}}{1-e^{-50}} + 0.24\left[1 - \frac{1-e^{-50PD_{in}}}{1-e^{-50}}\right] - 0.04\left[\frac{S_{in}-5}{45}\right]$$

(2) The second step is realised via the numerical estimation of the Bank's Probability to Default (BPD), obtained using the calibrated $A\hat{P}D_i$ and the actual capital of the bank CAP_i .

As the FIRB formula is based on a VaR, it is implicitly based on a probability discìribution for losses. The capital covers the losses up to the VaR threshold, but if losses are higher than capital the bank is in default. Typically banks hold more capital than required, and, evidenltly, the higher the actual capital, the higher the part of the losses probability distribution coverage.

So, the bank's probability to default, *BPD*, can be estimated as the part of the bank's losses probability distribution not covered by its capital. It is obtained inverting once more the FIRB formula, this time fixing APD_i and CAP_i and numerically finding the value of BPD_i that verifies the equation:

$$CAP_i = \left[0.45\ N\left[\sqrt{\frac{1}{1-R\left(A\hat{P}D_i, 50\right)}} N^{-1}\left(P\hat{D}_i\right) + \sqrt{\frac{R\left(A\hat{P}D_i, 50\right)}{1-R\left(A\hat{P}D_i, 50\right)}} N^{-1}\left(1 - B\hat{P}D_i\right) \right] - 0.45\ A\hat{P}D_i \right] \times$$

$$\left(1 - 1.5\ B\left(A\hat{P}D_i\right)\right)^{-1} \times 1.06$$

where

[3] See De Lisa et al., (2011) for a detailed explanation of all terms in this representation of the FIRB approach.

$i = 1, ..., H$ (banks), CAP_i is the actual capital and BPD_i is the probability to default of the bank *i*.

The third step consist in computing the impact of sovereign haircuts.As in the EBA exercise, the actual available capital in case of a haircut on sovereign bonds is considered to be proxied as the actual capital of the bank minus the reduction in value of the considered bonds. So, the capital to be considered after the haircut is $CAP_i - HC_i$ and after the haircut, we have:

$$CAP_i - HC_i = \left[0.45\, N\left[\sqrt{\frac{1}{1-R\left(A\hat{P}D_i, 50\right)}} N^{-1}\left(A\hat{P}D_i\right) + \sqrt{\frac{R\left(A\hat{P}D_i, 50\right)}{1-R\left(A\hat{P}D_i, 50\right)}} N^{-1}\left(1-B\hat{P}D_i'\right) \right] - 0.45\, A\hat{P}D_i \right] \times$$

$$\left(1-1.5\, B\left(A\hat{P}D_i\right)\right)^{-1} \times 1.06$$

where $B\hat{P}D_i'$ is the probability to default of the bank *i* after the haircut.

3.2. Results for haircuts effects estimation

The possible effects on a banking system of haircuts on sovereign debts are investigated following the methodology described in Section 3.1.

It is assumed that the haircut results in a reduction of bank's capital equivalent to the haircut fraction of 15% or 30% of the exposure. This is meant to represent an haircut in sovereigns of the same proportion, which is translated into a cut in the capital of banks of the same amount. This reduction in banks' capital generates an increase in banks' default probabilities (a reduced capacity on their side to cope with losses stemming from normal activity).

The following points should be considered when reading the results:

1. The exercise does not take into account possible systemic effects of contagion between banks, e.g. via the interbank market.
2. No information is so far available on the exposures of other (non-banks) investors to the considered government bonds. These investors are most likely investment and pension funds and insurance companies. No information is available on the relationship between these financial operators and banks.
3. Important assumptions are used in SYMBOL; the model does not take into account the rating of the bank, eventual provisions or the possibility that banks can raise capital.
4. The effects on single banks can be underestimated as all values considered refers to the whole group, and concentration of exposures within some banks of the groups are not considered.5.

Table 5 shows the effect of the haircut of some countries sovereign bonds on the default probability of the considered banking groups. Results are presented, aggregated by country showing the results for the two assumptions of an haircut of 15% and 30% respectively.[4]

As expected, the major effect of the haircut is within the country. Spill-over important effects can be observed in the case of a haircut on Greek sovereign debts for Cyprus banks, and Italian sovereign debts for Belgian and Luxembourg banks. The effect is clearly non linear in the amount of the haircut, due to the threshold effect exercised by the capital level of the bank owning the sovereigns.

It is worth reminding that, as reported in the final part of Section 2 for exposures, results aggregated per country are much smoother than the effects on individual banking groups

4 Under these assumptions the variation in the PD depends solely on the size of the exposure. Potentail differences in the haircut that could be applied in the considered countries, which would depend on market evaluation and governance among the others, are not taken into account.

Table 5: Weighted average probability of default of the banking groups in each country under possible haircuts (15% and 30% of the nominal value) of some countries sovereign bonds. The average is weighted on total assets.

	No haircut	GR		IE		IT		PT		ES	
		15%	30%	15%	30%	15%	30%	15%	30%	15%	30%
AT	0.130%	0.131%	0.131%	0.131%	0.131%	0.134%	0.137%	0.131%	0.131%	0.131%	0.131%
BE	0.091%	0.100%	0.111%	0.092%	0.092%	0.136%	0.217%	0.096%	0.100%	0.100%	0.095%
CY	0.094%	0.166%	0.315%	0.098%	0.102%	0.095%	0.097%	0.094%	0.094%	0.094%	0.094%
DE	0.099%	0.101%	0.103%	0.099%	0.100%	0.107%	0.117%	0.100%	0.101%	0.112%	0.105%
DK	0.057%	0.057%	0.057%	0.057%	0.057%	0.058%	0.060%	0.057%	0.057%	0.058%	0.057%
ES	0.169%	0.169%	0.169%	0.169%	0.169%	0.173%	0.178%	0.171%	0.174%	0.947%	0.358%
FI	0.157%	0.157%	0.157%	0.158%	0.159%	0.157%	0.157%	0.157%	0.157%	0.157%	0.157%
FR	0.155%	0.157%	0.160%	0.155%	0.156%	0.170%	0.188%	0.156%	0.157%	0.164%	0.159%
HU	0.050%	0.050%	0.050%	0.050%	0.050%	0.050%	0.050%	0.050%	0.050%	0.050%	0.050%
IE	0.292%	0.292%	0.293%	0.437%	0.708%	0.295%	0.297%	0.293%	0.294%	0.293%	0.292%
IT	0.168%	0.169%	0.170%	0.168%	0.168%	0.410%	2.942%	0.168%	0.169%	0.175%	0.171%
LU	0.011%	0.011%	0.011%	0.011%	0.011%	0.016%	0.025%	0.011%	0.011%	0.012%	0.011%
MT	0.042%	0.043%	0.043%	0.043%	0.043%	0.042%	0.043%	0.042%	0.042%	0.042%	0.042%
NL	0.102%	0.103%	0.104%	0.103%	0.103%	0.106%	0.109%	0.103%	0.104%	0.105%	0.103%
NO	0.153%	0.153%	0.153%	0.153%	0.153%	0.153%	0.153%	0.153%	0.153%	0.153%	0.153%
PL	0.192%	0.192%	0.192%	0.192%	0.192%	0.192%	0.192%	0.192%	0.192%	0.192%	0.192%
PT	0.229%	0.238%	0.247%	0.232%	0.236%	0.233%	0.238%	0.454%	1.056%	0.230%	0.230%
SE	0.183%	0.183%	0.183%	0.183%	0.183%	0.183%	0.183%	0.183%	0.183%	0.183%	0.183%
SI	0.163%	0.163%	0.163%	0.163%	0.164%	0.164%	0.166%	0.163%	0.163%	0.164%	0.164%
UK	0.092%	0.092%	0.092%	0.092%	0.092%	0.096%	0.100%	0.092%	0.092%	0.094%	0.093%
	0.128%	**0.130%**	**0.132%**	**0.130%**	**0.134%**	**0.154%**	**0.349%**	**0.132%**	**0.140%**	**0.202%**	**0.147%**

4. Analysis of adopted policy options

This section aims at comparing two policy options which have been proposed to address the fragilities of the EU financial sector and the issue of sovereign bonds held by financial institutions. The focus is on the comparison of the recapitalization required for the banks to comply with the proposed options.

4.1. The Basel III package

The Basel III package requires, among other things, a stricter definition and higher level of capital, and higher weights for some assets categories, that results in higher RWA, in order to increase the resilience of the banking sector to financial shocks. In the course of its regular monitoring EBA has estimated the average change in total capital and RWA expected from the implementation of the Basel III framework (seeTable 6) . These estimations are used in the present exercise to assess the proposed policy options

Table 6: Average estimated change in total capital ratio and RWA due to Basel III. Source: EBA (2011a)

	Group 1	Group 2
Average Tier1 capital ratio as of 30 June 2011	11.9%	10.9%
Average Tier1 capital ratio under Basel III	6.7%	7.4%
Change in RWA due to Basel III	21.2%	6.9%

To measure the recapitalization needs implied by the implementation of Basel III, the following scenarios are constructed:

1) Scenario 1.1, which will be labeled as Basel II, where the new Basel III definition of capital and RWA are applied and banks satisfy the Basel II capital ratios. The effects of implementing the new Basel III definitions are the ones estimated by EBA in their Quantitative Impact Study (EBA (2012a)), i.e. banks' total capital and RWA are adjusted using estimated average changes presented in Table 6. Data in Table 6 are used to estimate the increase in value of the RWA, and the reduced value of Tier1 capital as consequent to the new definitions. This scenario can be thought of as representing the situation of the EU banking systems at the beginning of the financial crisis, where risks where underestimated and the quality of capital was very poor.

2) Scenario 1.2, which will be labeled as Basel III 8%, where the new Basel III definition of capital and RWA are applied and banks are assumed to recapitalize to reach at least a minimum capital requirement equal to 8% of their RWA and a minimum Tier1 capital of 6.5%.

3) Scenario 1.3, which will be labeled as Basel III 10.5%, where the new Basel III definition of capital and RWA are applied and banks are assumed to recapitalize to reach at least a minimum capital requirement equal to 10.5% of their RWA and a minimum Tier1 capital of 8%.

Table 7 shows RWA, Tier1 and Tier1 ratios, under scenarios 1.1 to 1.3 and recapitalization needs, estimated comparing the amount of capital in scenario 1.2 and 1.3 with the ones in scenario 1.1.

Table 7: RWA, Tier 1 and Tier 1 ratios under the various scenarios.

	Data as of 31/12/2010			Basel II RWA (m€)	Scenario 1.1 (Basel II)		Scenario 1.2 (Basel III 8%)		Scenario 1.3 (Basel III 10.5%)		Recap needs Scenario 1.2 vs Scenario 1.1 (m€)	Recap needs Scenario 1.3 vs Scenario 1.1 (m€)
	RWA (m€)	Tier1 (m€)	Tier1 ratio		Tier1 (m€)	Tier1 ratio	Tier1 (m€)	Tier1 ratio	Tier1 (m€)	Tier1 ratio		
AT	242,475	24,023	9.9%	289,892	16,506	5.7%	17,502	6.04%	24,641	8.50%	995	8,134
BE	252,545	32,234	12.8%	306,085	21,996	7.2%	21,996	7.19%	26,017	8.50%	-	4,021
CY	53,904	5,643	10.5%	57,623	4,095	7.1%	4,095	7.11%	4,898	8.50%	-	803
DE	1,263,204	152,932	12.1%	1,528,476	104,469	6.8%	105,633	6.91%	133,013	8.70%	1,163	28,544
DK	179,612	28,025	15.6%	214,348	19,268	9.0%	19,268	8.99%	19,505	9.10%	-	238
ES	1,374,409	134,752	9.8%	1,665,784	91,953	5.5%	99,947	6.00%	141,592	8.50%	7,994	49,638
FI	42,728	5,454	12.8%	51,786	3,722	7.2%	3,722	7.19%	4,402	8.50%	-	680
FR	1,910,772	202,816	10.6%	2,315,856	138,399	6.0%	142,015	6.13%	196,848	8.50%	3,616	58,449
HU	26,774	3,753	14.0%	32,450	2,561	7.9%	2,561	7.89%	2,758	8.50%	-	197
IE	193,622	13,592	7.0%	232,409	9,348	4.0%	14,151	6.09%	19,755	8.50%	4,803	10,407
IT	1,085,485	97,196	9.0%	1,315,607	66,325	5.0%	78,936	6.00%	111,827	8.50%	12,611	45,502
LU	10,687	1,396	13.1%	11,425	1,013	8.9%	1,013	8.87%	1,013	8.87%	-	-
MT	3,381	354	10.5%	3,615	257	7.1%	257	7.10%	307	8.50%	-	50
NL	731,277	91,002	12.4%	883,143	62,202	7.0%	62,505	7.08%	75,963	8.60%	303	13,761
NO	106,168	10,733	10.1%	128,675	7,324	5.7%	7,721	6.00%	10,937	8.50%	396	3,613
PL	35,670	4,030	11.3%	43,232	2,750	6.4%	2,750	6.36%	3,675	8.50%	-	925
PT	231,395	20,718	9.0%	276,727	14,241	5.1%	16,660	6.02%	23,522	8.50%	2,419	9,281
SE	494,117	51,406	10.4%	598,869	35,079	5.9%	37,391	6.24%	50,904	8.50%	2,312	15,825
SI	20,579	1,387	6.7%	21,999	1,007	4.6%	1,320	6.00%	1,870	8.50%	313	863
UK	2,313,352	288,080	12.5%	2,803,783	196,582	7.0%	196,582	7.01%	238,322	8.50%	-	41,740
Total	**10,572,155**	**1,169,526**	**11.1%**	**12,781,783**	**799,096**	**6.3%**	**836,022**	**6.54%**	**1,091,768**	**8.54%**	**36,926**	**292,672**

4.2. Effects of recent EU Council decisions

Following the crisis of sovereign debts in some EU MS, in its meeting, the EU Council agreed on *requiring a significantly higher capital ratio of 9 % of the highest quality capital and after accounting for market valuation of sovereign debt exposures, to create a temporary buffer, which is justified by the exceptional circumstances*.

Table 8 shows the results of the aggregated impact of this new rule, as reported by the EBA, which calculated the recapitalization needs for each group.

It is worth noting that the variables considered for this exercise (the "highest quality capital" is technically the "Core Tier1") are not those considered in the Basel III rules (that refers to the "Tier1"), so the two regulatory interventions are not immediately comparable, but need to be evaluated through the effects they have on the banking groups.

The numbers in Table 8 are obtained as follows.

In the EBA implementation of the EC decision, the current level of Core Tier1 capital held by banks is the base reference considered for estimations. Shortfalls to 9% of RWA as Core Tier1 for each banking group are then quantified (first column in Table 8).

Then, given the sovereign debt exposures, the sovereign buffers of each banking group are estimated. These additional capital buffers are reported in column 3 of Table 8.

The last two columns of Table 8 present for comparison purposes the recapitalization needs of the Basel III package based on the value of total capital, corrected for the new Basel III definitions of capital and risk weighted asset and introduction of the Capital Conservation Buffer (CCB). These recapitalisation needs are obtained in three steps:

(i) applying to the level of Tier1 capital as of December 2010 the reduction in Tier1 capital due to the adoption of new definitions, estimated by EBA on the basis of its Quantitative Impact Study;

(ii) applying to the level of RWA as of December 2010 the increase due to the adoption of new definitions, estimated by EBA on the basis of its Quantitative Impact Study;

(iii) calculating the amount of Tier1 capital necessary to reach a minimum ratio of 6% (no CCB) or of 8.5% (CCB included).

Data in Table 8 show that for almost all countries the Council decision is in between the Basel III 8% (Tier 1 6%) and Basel III 10.5% (Tier 1 8.5%) estimated values, so it results in a large anticipation of the implementation of the Basel III package.

Table 8: Country recapitalization needs under the new rule approved in October 2011 by the EU Council vs Basel III

Country	EBA capital exercise			Basel III estimated effects	
	Core Tier1 shortfall to 9% before application of sovereign capital buffer (m€)	**Sovereign capital buffer (m€)**	**Overall Shortfall after including sovereign capital buffer**	**Tier1 shortfall to 6% under Basel III (m€)**	**Tier1 shortfall to 8.5% under Basel III (m€)**
AT	3,812	112	3,923	995	8,134
BE	1,539	4,774	6,313	-	4,021
CY	1,075	2,457	3,531	-	803
DE	7,431	7,563	13,107	1,163	28,544
DK	-	22	-	-	238
ES	19,610	6,561	26,170	7,994	49,638
FI	-	-	-	-	680
FR	4,881	3,512	7,324	3,616	58,449
HU	-	33	-	-	197
IE	-	815	-	4,803	10,407
IT	8,624	9,674	15,366	12,611	45,502
LU	-	-	-	-	-
MT	-	1	-	-	50
NL	-	183	159	303	13,761
NO	1,520	-	1,520	396	3,613
PL	-	-	-	-	925
PT	3,232	3,718	6,950	2,419	9,281
SE	-	2	-	2,312	15,825
SI	320	4	320	313	863
UK	-	-	-	-	41,740
TOTAL	**52,043**	**39,428**	**84,685**	**36,926**	**292,672**

5. Aftermath: European banks' exposures on European countries public sector rebalancing

After the sovereign crisis and the EU council intervention the exposures of the different MS to EU sovereign bonds has changed, as shown in Table 9.. A relevant reallocation of the exposures is evident from the following table.

While the overall amount of euro area bonds in the capital of euro area banks has grown by 185 b€ in 2011, the composition in terms of countries has changed. The most relevant reductions in sovereign hold by bank concern Italy (-56 bn), Spain (-38 bn), Greece (- 22 bn), while the most important increases concern France (+35 bn), Finland (+29 bn) and Luxembourg (+27 bn).

Table 9: Exposures of EU banks to sovereign debts. Source: BIS, quarterly review, Table 9E: Consolidated foreign claims and other potential exposures - ultimate risk basis

Country	Exposures at 31/12/2010 (m€)	Exposures at 31/12/2011 (m€)	Variation (m€)	Variation %
AT	37,718	37,071	-647	-2%
BE	66,202	69,085	2,882	+4%
CZ	29,437	38,527	9,089	+31%
DK	11,760	9,151	-2,609	-22%
FI	16,604	45,662	29,059	+175%
FR	101,902	137,263	35,360	+35%
DE	226,427	205,653	-20,774	-9%
GR	39,042	16,383	-22,659	-58%
IE	11,472	8,402	-3,070	-27%
IT	164,793	108,562	-56,232	-34%
LU	10,701	37,919	27,219	+254%
NE	45,984	71,605	25,621	+56%
NO	16,697	8,439	-8,258	-49%
PO	53,130	48,849	-4,280	-8%
PT	24,197	18,312	-5,885	-24%
ES	65,786	27,166	-38,619	-59%
SE	5,143	3,207	-1,936	-38%
UK	64,542	67,963	3,421	+5%
All countries	**2,205,011**	**2,389,750**	**+184,740**	**+8%**

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Annex 1

List of banks included in the exercise and recapitalisation needs as a consequence of possible haircuts.

Key:

Needed: the actual capital, after the Basel III estimated corrections is not sufficient to reach the 6% minimum required. So in any case a recapitalisation is needed.

No: the actual capital, after the Basel III estimated corrections is above the 6% minimum required eve in case of zero value for the sovereign bonds of the considered country. So in any case a recapitalisation is not needed

XX% the actual capital, after the Basel III estimated corrections is sufficient to reach the 6% minimum required, but, in case of the reduction in value of the considered country sovereign bonds above XX%, a recapitalisation is needed.

	Haircut for TIER1 BIII recap need to 6%				
Banks	**Greece**	**Italy**	**Spain**	**Ireland**	**Portugal**
Erste Group Bank AG	Needed	Needed	Needed	Needed	Needed
Raiffeisen Bank International AG	Needed	Needed	Needed	Needed	Needed
Oesterreichische Volksbanken AG	No	77%	No	No	No
Dexia	58%	15%	No	No	No
KBC Bank NV	No	42%	No	No	No
Marfin Popular Bank Public Co Ltd	7%	No	No	No	No
Bank of Cyprus Public Company Limited-Bank of Cyprus Group	22%	No	No	No	No
Deutsche Bank AG	No	No	No	No	No
Commerzbank AG	76%	24%	75%	No	No
Landesbank Baden-Wuerttemberg	96%	20%	30%	No	75%
DZ Bank AG-Deutsche Zentral-Genossenschaftsbank	Needed	Needed	Needed	Needed	Needed
Bayerische Landesbank	No	No	87%	No	No
Norddeutsche Landesbank Girozentrale NORD/LB	Needed	Needed	Needed	Needed	Needed
Hypo Real Estate Holding AG	No	54%	No	No	No
WestLB AG	No	33%	35%	No	No
HSH Nordbank AG	No	No	No	No	No
Landesbank Hessen-Thüringen GZ, Frankfurt	Needed	Needed	Needed	Needed	Needed
Landesbank Berlin AG	No	No	No	No	No
DekaBank Deutsche Girozentrale	No	No	No	No	No
WGZ-Bank AG Westdeutsche Genossenschafts-Zentralbank	No	56%	60%	No	No
Danske Bank A/S	No	No	No	No	No
Jyske Bank A/S (Group)	No	No	No	No	No
Sydbank A/S	No	No	No	No	No
Nykredit Bank A/S	No	No	No	No	No
Banco Santander SA	Needed	Needed	Needed	Needed	Needed
Banco Bilbao Vizcaya Argentaria SA	Needed	Needed	Needed	Needed	Needed
Bankia, SAU	Needed	Needed	Needed	Needed	Needed
Caja de Ahorros y Pensiones de	Needed	Needed	Needed	Needed	Needed

	Haircut for TIER1 BIII recap need to 6%				
Banks	**Greece**	**Italy**	**Spain**	**Ireland**	**Portugal**
Barcelona-LA CAIXA					
Banco Popular Espanol SA	Needed	Needed	Needed	Needed	Needed
Pohjola Bank plc-Pohjola Pankki Oyj	No	No	No	No	No
BNP Paribas	73%	13%	68%	No	No
Crédit Agricole S.A.	Needed	Needed	Needed	Needed	Needed
BPCE SA	Needed	Needed	Needed	Needed	Needed
Société Générale	Needed	Needed	Needed	Needed	Needed
Royal Bank of Scotland Group Plc (The)	No	No	No	No	No
HSBC Holdings Plc	No	96%	No	No	No
Barclays Plc	No	No	No	No	No
Lloyds Banking Group Plc	No	No	No	No	No
OTP Bank Plc	No	No	No	No	No
Allied Irish Banks plc	Needed	Needed	Needed	Needed	Needed
Bank of Ireland	Needed	Needed	Needed	Needed	Needed
Irish Life & Permanent Plc	No	No	No	9%	No
Intesa Sanpaolo	Needed	Needed	Needed	Needed	Needed
UniCredit SpA	Needed	Needed	Needed	Needed	Needed
Monte dei Paschi di Siena	Needed	Needed	Needed	Needed	Needed
Banco Popolare	Needed	Needed	Needed	Needed	Needed
Unione di Banche Italiane Scpa-UBI Banca	Needed	Needed	Needed	Needed	Needed
Banque et Caisse d'Epargne de l'Etat Luxembourg	No	23%	No	No	No
Bank of Valletta Plc	No	No	No	No	No
ING Bank NV	Needed	Needed	Needed	Needed	Needed
Rabobank Nederland-Rabobank Group	No	No	No	No	No
ABN AMRO Group N.V.	No	No	No	No	No
SNS Bank N.V.	No	65%	No	No	No
DnB NOR Bank ASA	Needed	Needed	Needed	Needed	Needed
Powszechna Kasa Oszczednosci Bank Polski SA - PKO BP SA	No	No	No	No	No
Caixa Geral de Depositos	Needed	Needed	Needed	Needed	Needed
Banco Comercial Português, SA-Millennium bcp	Needed	Needed	Needed	Needed	Needed
Banco Espirito Santo de Investimento, SA-BES Investimento	Needed	Needed	Needed	Needed	Needed
Banco BPI SA	29%	6%	No	18%	2%
Nordea Bank AB (publ)	Needed	Needed	Needed	Needed	Needed
Skandinaviska Enskilda Banken AB	No	No	No	No	No
Svenska Handelsbanken	Needed	Needed	Needed	Needed	Needed
Swedbank AB	No	No	No	No	No
NLB dd-Nova Ljubljanska Banka d.d.	Needed	Needed	Needed	Needed	Needed
Nova Kreditna Banka Maribor d.d.	Needed	Needed	Needed	Needed	Needed
Banco Espirito Santo de Investimento, SA-BES Investimento	73%	13%	68%	No	No

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Abstract

This paper aims at investigating some of the critical issues highlighted by the sovereign debt crisis in European Union (EU) Member States (MS). The goal is twofold:

1) Quantify the increase in the risks of the EU banking systems due to haircuts of sovereign debts of some EU Member States, which have been particularly touched by the sovereign crisis;

2) evaluate and compare the policy options which have been adopted to address the issue.

The first goal is achieved by estimating the increase in the banks Probability to Default (PD), due to the haircuts in sovereingn debts, through a further development of the SYMBOL model to estimate the PDs by numerical inversion of the Basel FIRB formula for minimum capital requirements.

For the second objective the measures within the Basel III Accord, which among the others increases the quality and quantity of capital that banks should set aside to cover from unexpected losses, are compared with the agreement on bank recapitalisation and funding reached by the European Council in October 2011, which responded to the urgent consequences of the sovereign bonds crisis in the EU.

The analysis is performed on the 65 large EU banking groups identified by the European Banking Authority (EBA) for the capitalisation exercise..

Results show that the haircuts on sovereign debts of EU MS in crisis would heavily worsen the stability of their banking systems but could also sometimes affect financial stability of other EU countries. We also show that the creation of a temporary capital buffer in the form of a capital target, necessitated by the exceptional circumstances prevailing in some EU MS, represent a step forward to Basel III rules

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